

Appendix N

Noise Guidelines for Review of New Development

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Measurement of Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its pitch or its loudness. Pitch is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. Loudness is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A decibel (dB) is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities.

There are several methods of characterizing sound. The most common in California is the A-weighted sound level or dBA. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy-equivalent sound/noise descriptor is called Leq. The most common averaging period is hourly, but Leq can describe any series of noise events of arbitrary duration. The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night --because excessive noise interferes with the ability to sleep --24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The Community Noise Equivalent Level, CNEL, is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm -10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The Day/Night Average Sound Level, Ldn, is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Hearing Loss. While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise, but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise. The Occupational Safety and Health Administration (OSHA) has a noise exposure standard which is set at the noise threshold where hearing loss may occur from long-term exposures. The maximum allowable level is 90 dBA averaged over eight hours. If the noise is above 90 dBA, the allowable exposure time is correspondingly shorter.

Sleep and Speech Interference. The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noise of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA Ldn. Typically, the highest steady traffic noise level during the daytime is about equal to the Ldn and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57 -62 dBA Ldn with open windows and 65- 70 dBA Ldn if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65- 70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed, those facing major roadways and freeways typically need special glass windows.

Annoyance. Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The Ldn as a measure of noise has been

found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 55 dBA Ldn. At an Ldn of about 60 dBA, approximately 2 percent of the population is highly annoyed. When the Ldn increases to 70 dBA, the percentage of the population highly annoyed increases to about 12 percent of the population. There is, therefore, an increase of about 1 percent per dBA between an Ldn of 60- 70 dBA. Between an Ldn of 70-80 dBA, each decibel increase increases by about 2 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the Ldn is 60 dBA, approximately 10 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 2 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 3 percent increase in the percentage of the population highly annoyed.

Guidelines for the Review of New Development

A. New development projects shall meet acceptable noise level standards. The “acceptable” noise standards for new land uses as established in Land Use Compatibility for Community Exterior Noise Environments (see Figure 1) shall be used with further consideration of the following:

1. The maximum acceptable exterior noise level in residential areas is an L_{dn} of 55 dB for single-family development and an L_{dn} of 60 dB for multi-family development. These levels shall guide the design and location of future development, and are the goals for the reduction of noise in existing development. These goals will be applied where outdoor use is a major consideration (e.g., backyards in single-family housing developments and recreation areas in multi-family housing projects). The outdoor standard will normally be applied to any area considered to be “useable open space”, including decks and balconies associated with apartments and condominiums.
2. Indoor noise level shall not exceed an L_{dn} of 45 dB in new housing units.
3. If the primary noise source is aircraft or a railroad, noise levels in new residential development exposed to an exterior L_{dn} of 60 dB or greater should be limited to a maximum instantaneous noise level in bedrooms at night of 50 dB(A). Maximum instantaneous noise levels in bedrooms during the daytime and in other rooms should not exceed 55 dB(A).

4. If the primary noise source is a commercial or industrial land use, new residential development shall not be allowed where the ambient noise level due to commercial or industrial noise sources will exceed the noise level standards as set forth in Table 1. Each of the noise level standards specified in Table 1, “Noise and Land Use Compatibility Standards for Industrial and Commercial Noise”, shall be reduced by 5 dB(A) for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises.
5. Appropriate interior noise levels in commercial, industrial, and office buildings are a function of the use of space and shall be evaluated on a case-by-case basis. Interior noise levels in offices generally should be maintained at 52 L_{eq} (hourly average) or less.

The noise guidelines and contours will be used to determine if additional noise studies are needed for proposed new development. Noise studies shall follow a standard format and guidelines.

B. Protect the noise environment in existing residential areas. The guidelines are not intended to be applied reciprocally. In other words, if an area currently is below the desired noise standards, an increase in noise up to the maximum should not necessarily be allowed. The impact of a proposed project on an existing land use should be evaluated in terms of the potential for adverse community response based on a significant increase in existing noise levels, regardless of the compatibility guidelines. Specific examples of these situations are described below:

1. The project has the potential to generate significant adverse community response due to the increased character of the noise it would generate.
2. Noise created by commercial or industrial sources associated with new project or developments shall be controlled so as not to exceed the noise level standards set forth in Table 1 as measured at any affected residential land use. The allowable noise level shall be adjusted up to the ambient noise level.

In general, the City will require the evaluation of mitigation measures for projects that would cause the L_{dn} to increase by 3 dB(A) or more at an existing residential area.

C. Locate noise sensitive uses away from noise sources unless mitigation measures are included in development plans. Protect schools, hospitals, libraries, churches, convalescent homes, and other noise sensitive uses from noise levels exceeding those allowed in residential areas.

D. Design city streets to reduce noise levels in adjacent areas. Continue to require soundwalls, earth berms, and other noise reduction techniques (e.g., “open grade” or “rubberized” asphalt) as conditions of development approval.

Figure 1

Land Use Compatibility Standards for Community Noise Environments

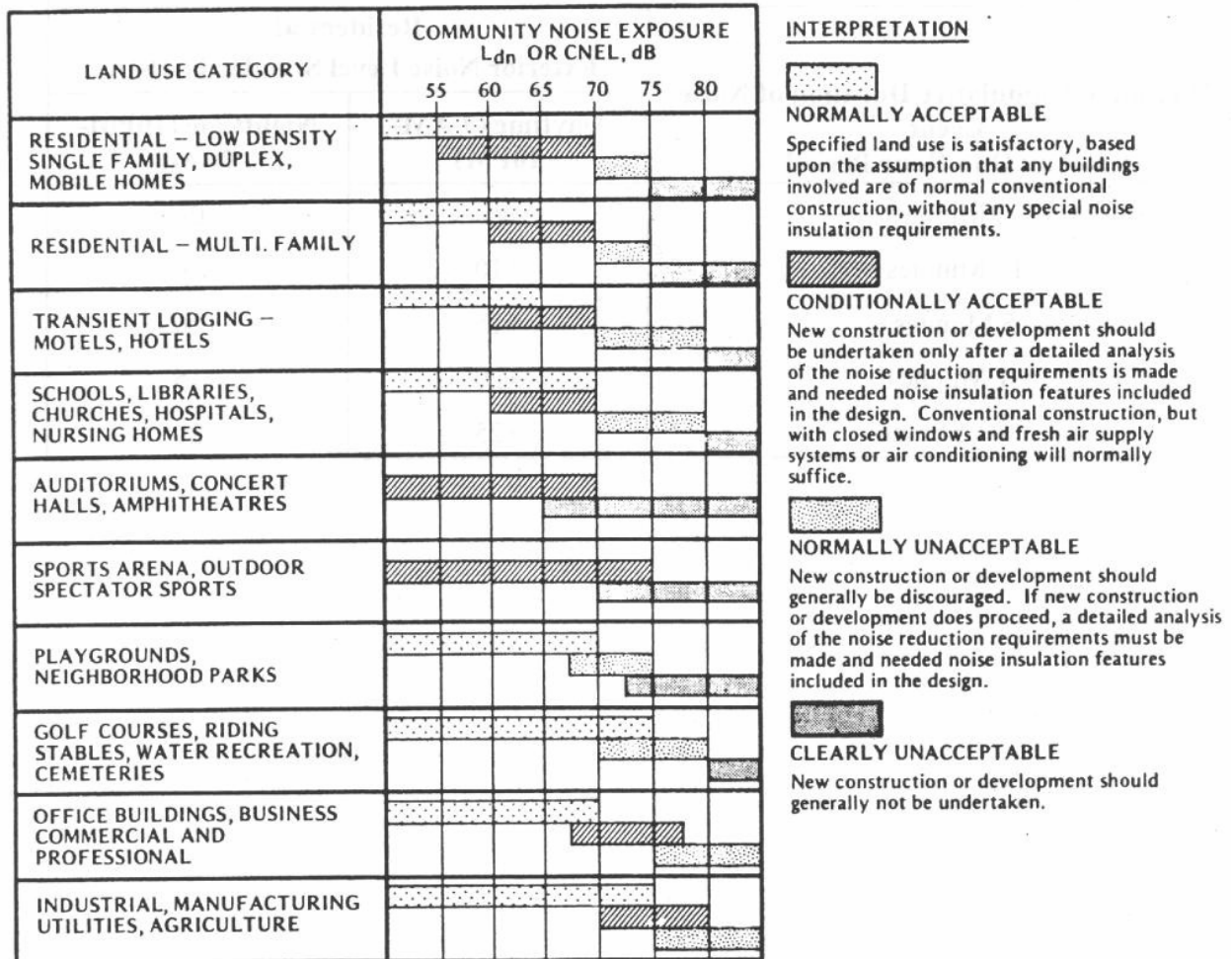


Table 1**Noise and Land Use Compatibility Standards***Adjustments to Ambient Noise Levels for Periodic Noise Events*

Maximum Cumulative Duration of Noise Event in Any One-Hour Period	Residential Exterior Noise Level Standards dB(A)	
	Daytime (7 AM-10PM)	Nighttime (10PM-7AM)
30 Minutes+	+5	0
15 Minutes+	+10	+5
5 Minutes+	+15	+10
1 Minute+	+20	+15
0-1 Minute	+25	+20